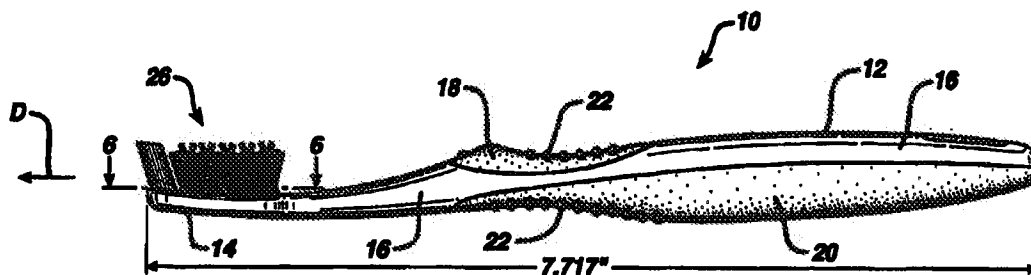




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: TOOTHBRUSH



## (57) Abstract

A toothbrush (10) having a handle (12) and a plurality of tufts of bristles (26) secured to the head (14). One of the tufts is secured to the head (14) at a location such that no other tuft is secured to the head at a location that is more distal from the handle (12) than the location where the one tuft is secured to the head (14). The one tuft is angled by about 81 degrees or less relative to an imaginary line which is tangent to a co-planar with a surface of the head through which the one tuft secured to the head (14). The one tuft is tilted away from the handle (12) towards a direction along which the head (14) extends from the handle (12).

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### TOOTHBRUSH

The invention relates generally to the field of oral care, and in particular to toothbrushes. More particularly, the invention relates to a toothbrushes with a three-dimensional bristle profile to provide improved cleaning of interproximal and gingival marginal regions of teeth.

Toothbrushing and flossing are fundamental steps in achieving good oral hygiene. The practice of flossing, unfortunately, has not met with widespread acceptance among the general populace even though it is acknowledged by the general populace that flossing is something that should be completed as part of good oral hygiene. Furthermore, even people who floss oftentimes do not perform adequate flossing in hard to reach areas of the mouth. Unfortunately, while most commercially available toothbrushes clean the outer buccal face of teeth adequately, they fail to provide improved cleaning of plaque and debris from the gingival margin, interproximal areas, lingual surfaces and other hard to reach areas of the mouth.

One reason that such toothbrushes do not adequately clean the rear-most molars (e.g. wisdom teeth or second molars) is that the one or more tufts secured to the toothbrush head at a location most distal from the toothbrush handle are not angled towards a direction along which the head extends from the handle. As such, these tufts cannot extend far enough past the end of the head of the toothbrush to sufficiently clean the molar teeth in the back of the mouth.

Additionally, in those brushes having tufts of bristles which angle towards the handle and other tufts which angle away from the handle, all of such tufts are essentially the same length and have the same cross-section. Consequently, while these angled tufts may clean one part of the teeth in a satisfactory manner, other parts of the teeth will not be cleaned sufficiently due to the homogeneous length, spacing and cross-section of the tufts.

Further, prior art toothbrushes disclose tufts of bristles having at most three different types of cross-sections. However, there are more than three parts of the teeth which need to be cleaned by a brush (e.g. the outer buccal face, gingival margin, interproximal areas, lingual surfaces and rearward most molars). As such, prior art brushes do not provide tufts of sufficiently varied cross-section specifically designed to clean all areas of the teeth.

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The present invention is directed to overcoming one or more of the problems set forth above. Briefly summarized, according to one aspect of the present invention, a toothbrush includes a handle, a head extending from the handle, and a plurality of tufts of bristles secured to the head. One of the tufts is secured to the head at a location such that no other tuft is secured to the head at a location which is more distal from the handle than the location where the one tuft is secured to the head. The one tuft is angled by about 81 degrees or less relative to an imaginary line which is tangent to or co-planar with a surface of the head through which the one tuft is secured to the head. The one tuft is tilted away from the handle towards a direction along which the head extends from the handle.

By angling the one tuft as described in the previous paragraph, the tuft is able to extend past the end of the head of the toothbrush and thus clean molars in the back of the mouth in a more sufficient manner.

According to another aspect of the invention, a toothbrush includes a handle, a head extending from the handle, and a plurality of tufts of bristles secured to the head. Two of the tufts are each at an acute angle relative to an imaginary line which is tangent to or co-planar with a surface of the head through which the two tufts are secured to the head. The two tufts have a different characteristic from each other selected from the group of characteristics consisting of length, cross-section, color, material and combinations thereof.

Providing angled tufts which vary in their length, cross-section, color, materials or combinations thereof, allows such angled tufts to clean more than one part of the teeth. For example, one type of angled tuft will clean the buccal face of teeth while another type of angled tuft will clean the interproximal areas of the teeth.

According to a third aspect of the invention, a toothbrush includes a handle, a head extending from the handle, and, a multiplicity of tufts of bristles secured to the head. The multiplicity of tufts include tufts with at least five different types of cross-sections.

By providing tufts with at least five types of cross-sections, these tufts can clean all areas of the teeth (e.g. the outer buccal face, gingival margin, interproximal areas, lingual surfaces and rearward most molars) properly.

These and other aspects, objects, features and advantages of the present

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invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

FIG. 1 is a perspective view of a toothbrush according to the present invention;

FIG. 2 is a top view of the toothbrush of FIG. 1;

FIG. 3 is a side view of the toothbrush of FIG. 1;

FIGs. 4 and 5 are partial side views of the head and respective portions of the tufts of the toothbrush of FIG. 1;

FIG. 6 is a partial sectional view of the head of the toothbrush taken along the lines of 6-6 of FIG. 3; and

FIG. 7 perspective view of the head and a portion of the handle of the toothbrush of FIG. 1.

Beginning with FIGs. 1-3, a toothbrush 10 includes a handle portion 12 and a head portion 14 which extends from the handle in a direction D. The overall length of toothbrush 10 is preferably about 7.7 inches while the width of head 14 at its widest portion is preferably about 0.5 inches. A main portion 16 of handle 12, and head 14 are made of a unitary piece of polypropylene. Remaining portions of handle 12, including thumb gripping portion 18, optional Trademark 24 (preferably about .83 inches long) and finger gripping portion 20 are preferably made of a thermoplastic elastomer, preferably kraton rubber (a hydrogenated or unhydrogenated oil filled block co-polymer of styrene and butadiene or isoprene having a shore A hardness of between about 5 and about 70). Thumb gripping portion 18 and a portion of finger gripping portion 20 have a series of seventeen raised ribs 22 which aid in the gripability of the handle. Ribs 22 are preferably .05 inches in width.

With reference to FIGs. 3-7, a plurality of tufts 26 of bristles are secured to head 14 of the toothbrush. Each tuft is made up of a large number of bristles, and all of the bristles are preferably end-rounded. There are five different types of tufts secured to the head each tuft type having a cross-section which differs in both area and shape to the other tuft types.

A first type of tuft, type 28, is made up of bristles formed of polybutylene-terephthalate (PBT) with an abrasive such as kaolin clay particles mixed

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throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional tufted area for tuft 28 is about 0.0373 square inches, providing a tuft volume measured from the head surface of about .0164 cubic inches (preferably this volume is between about .015 and .018 cubic inches). There is only one type 28 tuft secured to head 14 and it is located more distal from handle 14 than any other tuft.

A second type of tuft, type 32, is made up of nylon Indicators™ type bristles which are formed of 6.12 nylon and colored blue on their external surface. As is well known in the art, the blue coloring on these bristles is slowly worn away as the brush is used over time to indicate the extent to which the toothbrush is worn. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .350 inches. The cross-sectional area of each tuft 32 is about 0.0045 square inches. As shown in FIG. 6, type 32 tufts have a round cross-section. There are between 8 and 12 type 32 tufts secured to head 14.

A third type of tuft, type 34, is made up of bristles formed of PBT with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional area of each tuft 34 is about 0.0027 square inches. There are between eight and twelve type 34 tufts secured to head 14. As shown in FIG. 6, type 34 tufts are rectangular in shape with rounded ends.

A fourth type of tuft, type 36, is made up of bristles formed of PBT with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional area of each tuft 36 is about 0.0040 square inches. There are between four and six type 36 tufts secured to head 14. As shown in FIG. 6, type 36 tufts are rectangular in shape with rounded ends, and are wider across the head than type 34 tufts.

A fifth and final type of tuft, type 38, is made up of bristles formed of

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PBT with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .006 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .350 inches. The cross-sectional area of each tuft 38 is about 0.0084 square inches.

- 5 There are between four and six type 38 tufts secured to head 14. As shown in FIG. 6, type 36 tufts are rectangular in shape with rounded ends, and are wider than type 36 tufts.

Based on the cross-sectional areas of the various tufts described above, tuft type 28 has a cross-section which is more than four times as large as any other tuft secured to head 14. Although specific materials were described above from which the  
10 bristles of each tuft are made, other materials can be used. As such, any of the bristles attached to head 14 could be made from, for example, PBT with or without an abrasive such as kaolin clay, 6.12 nylon with or without an abrasive, or nylon Indicator™ material with or without an abrasive.

- 15 Additionally, the bristles within a tuft and between tufts can have varying lengths, diameters, cross-sectional shapes, cross-sectional areas, colors and be made of differing materials.

As best seen in FIGs. 2, 4 and 5 and seven, all of the tufts on head 14 are angled either towards direction D or towards the direction opposite of direction D  
20 by preferably less than about 81 degrees, more preferably between about 69 degrees to about 81 degrees, and most preferably by about 75 degrees, relative to an imaginary straight line 40 which is tangent to surface 30 of head 14. If surface 30 was flat, rather than curved, then line 40 would be co-planar with surface 30. Two outer rows of tufts 42 are angled towards direction D away from handle 12. An inner row of tufts  
25 44 are angled opposite direction D towards handle 12 with the exception of large tuft 28 which is tilted towards direction D away from handle 12.

Toothbrush 10 can be made by the following process which is generally understood by those skilled in the art. Each of the tufts of bristles are formed by gathering together a desired amount of bristles of a selected material, length and  
30 diameter. The tufts are then inserted into apertures in part of a mold of an injection molding machine. An end of the tuft which is or will project into the mold cavity is then melted to join the bristles together in a fused mass or ball at that end of the tuft.

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The mold part bearing the tufts is then joined with another portion of the mold which together define a cavity used to form main portion 16 of the toothbrush. The fused masses of the tufts are located just within the cavity.

5 Polypropylene is then injected into the cavity to form portion 16 of toothbrush 10. The polypropylene is then cooled at which point the partially finished toothbrush is moved to a second injection molding station. The cooled, hardened polypropylene secures the fused masses of the tufts to head 14 of the toothbrush. At the second molding station, the partially finished brush is put into a second mold having cavities to form the thumb gripping portion 18, trademark 24 and finger  
10 gripping portion 20. A thermoplastic elastomer is then injected into the mold after which the elastomer is cooled and finished toothbrush 10 is removed from the mold. The toothbrush is then packaged.



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CLAIMS

1. A toothbrush, comprising:  
a handle;  
a head extending from the handle; and  
5 a plurality of tufts of bristles secured to the head, one of the tufts being secured to the head at a location such that no other tuft is secured to the head at a location which is more distal from the handle than the location where the one tuft is secured to the head, the one tuft being angled by about 81 degrees or less relative to an imaginary line which is tangent to or co-planar with a surface of the head through  
10 which the one tuft is secured to the head, the one tuft being tilted away from the handle towards a direction along which the head extends from the handle.
2. The toothbrush of claim 1, wherein the one tuft is angled by between about 69 to about 81 degrees from the imaginary line.
3. The toothbrush of claim 2, wherein the one tuft is angled by about 75  
15 degrees from the imaginary line.
4. The toothbrush of claim 1, wherein the plurality of tufts include the one tuft and at least two other tufts, the two other tufts both being angled relative to the imaginary line, the two other tufts having different lengths when measured from the surface.
- 20 5. The toothbrush of claim 4, wherein the two other tufts differ in length by about .090 inches.
6. The toothbrush of claim 1, wherein the plurality of tufts include the one tuft and at least two other tufts, the two other tufts both being angled relative to the imaginary line, the two other tufts having different cross-sections.
- 25 7. The toothbrush of claim 6, wherein the cross-sections differ in shape.
8. The toothbrush of claim 6, wherein the cross-sections differ in area.
9. The toothbrush of claim 1, wherein the cross-sectional area of the one tuft is at least four times as large as the cross-sectional area of any other tuft secured to the head.
- 30 10. The toothbrush of claim 1, wherein no other tuft is secured to the head at a location which is as distal from the handle as the location where the one tuft is secured to the head.

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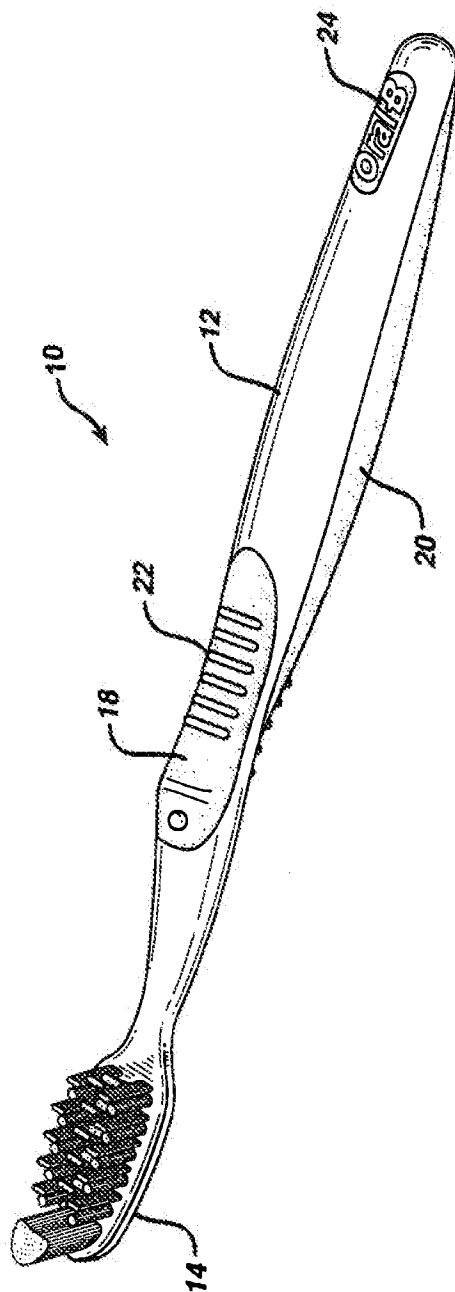
11. A toothbrush, comprising:  
a handle;  
a head extending from the handle; and  
a plurality of tufts of bristles secured to the head, two of the tufts each  
5 being at an acute angle relative to an imaginary line which is tangent to or co-planar  
with a surface of the head through which the two tufts are secured to the head, the two  
tufts having a different characteristic from each other selected from the group of  
characteristics consisting of length, cross-section, color, material and combinations  
thereof.
- 10 12. The toothbrush of claim 11, wherein the characteristic is length, and the  
difference in length between the two tufts is about .090 inches.
13. The toothbrush of claim 11, wherein the characteristic is cross-section,  
and the cross-sections differ in area.
14. The toothbrush of claim 11, wherein the characteristic is cross-section,  
15 and the cross-sections differ in shape.
15. The toothbrush of claim 11, further comprising:  
a third tuft, the third tuft being secured to the head at a location such  
that no other tuft is secured to the head at a location which is more distal from the  
handle than the location where the third tuft is secured to the head.
- 20 16. The toothbrush of claim 15, wherein the third tuft is angled by between  
about 69 to about 81 degrees from the imaginary line.
17. The toothbrush of claim 16, wherein the third tuft is angled by about 75  
degrees from the imaginary line.
18. The toothbrush of claim 15, wherein the cross-sectional area of the third  
25 tuft is at least four times as large as the cross-sectional area of any other tuft secured  
to the head.
19. The toothbrush of claim 15, wherein no other tuft is secured to the head  
at a location which is as distal from the handle as the location where the third tuft is  
secured to the head.
- 30 20. The toothbrush of claim 11, wherein the two tufts are angled towards  
substantially opposite directions, one of the tufts being angled towards the handle and  
the other of the tufts being angled away from the handle.

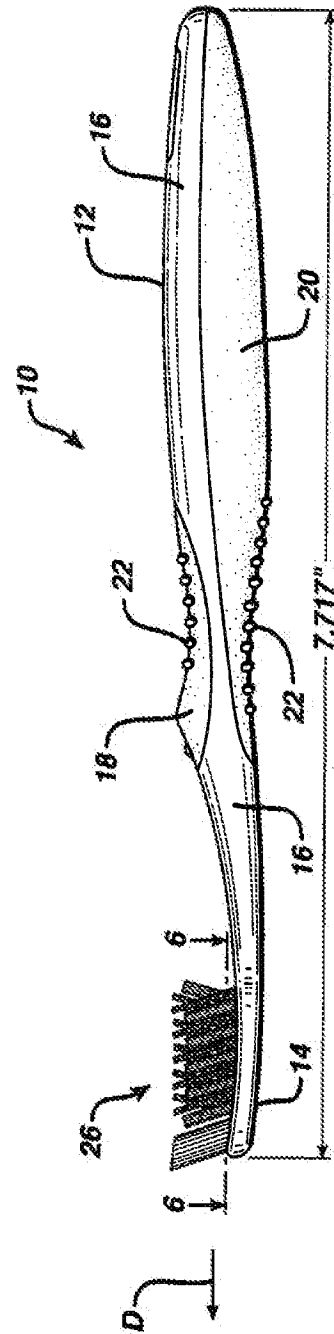
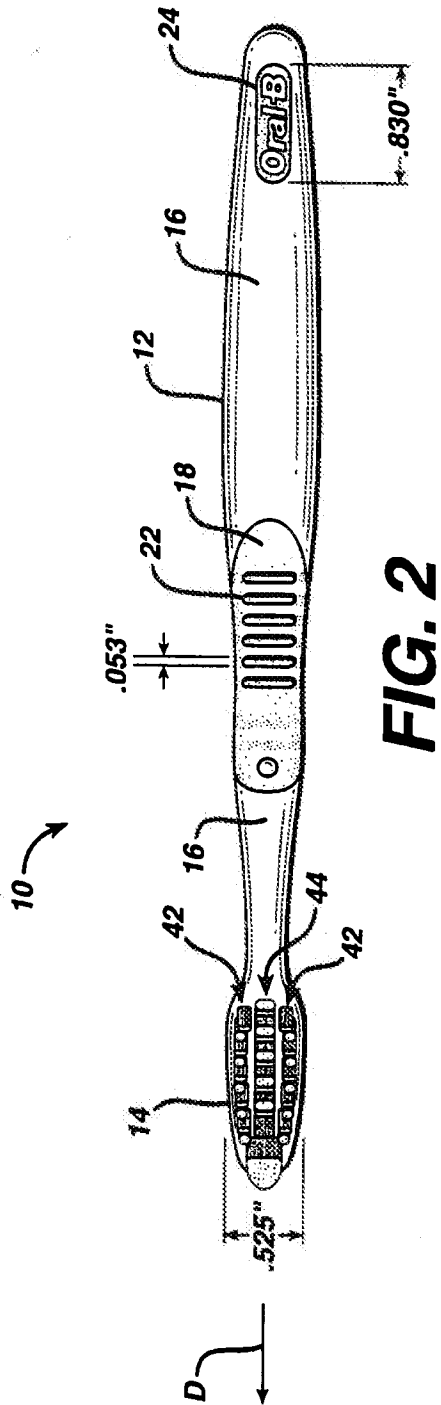
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21. A toothbrush, comprising:  
a handle;  
a head extending from the handle; and  
a multiplicity of tufts of bristles secured to the head, the multiplicity of  
5 tufts including tufts with at least five different types of cross-sections.
22. The toothbrush of claim 21, wherein the cross-sections differ in area.
23. The toothbrush of claim 21, wherein the cross-sections differ in shape.
24. The toothbrush of claim 15, wherein the third tuft is angled by about 81  
degrees or less relative to the imaginary line and tilted away from the handle towards a  
10 general direction from which the head extends from the handle.
25. The toothbrush of claim 1, wherein one or more of the bristles has a  
characteristic which is different from the other bristles, the characteristic being selected  
from the group consisting of length, diameter, cross-sectional area, cross-sectional  
shape, color, material and combinations thereof.
- 15 26. The toothbrush of claim 11, wherein one or more of the bristles has a  
characteristic which is different from the other bristles, the characteristic being  
selected from the group consisting of length, diameter, cross-sectional area, cross-  
sectional shape, color, material and combinations thereof.
27. The toothbrush of claim 1, wherein the one tuft has a tuft volume  
20 measured from the head surface of between about .015 and .018 cubic inches.
28. The toothbrush of claim 11, wherein the two tufts are angled towards  
substantially the same direction.
29. The toothbrush of claim 11, wherein the two tufts are angled by between  
about 69 to about 81 degrees from the imaginary line.
- 25 30. The toothbrush of claim 29, wherein the two tufts are angled by about  
75 degrees from the imaginary line.

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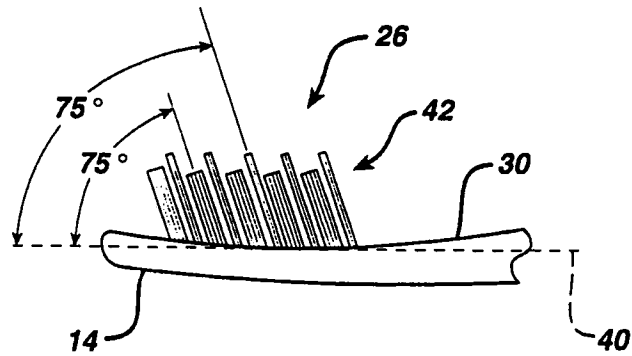
**FIG. 1**



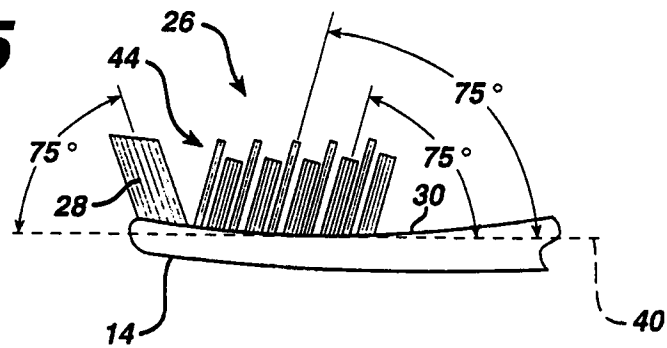


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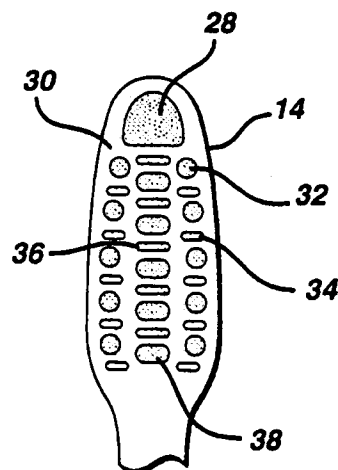
**FIG. 4**



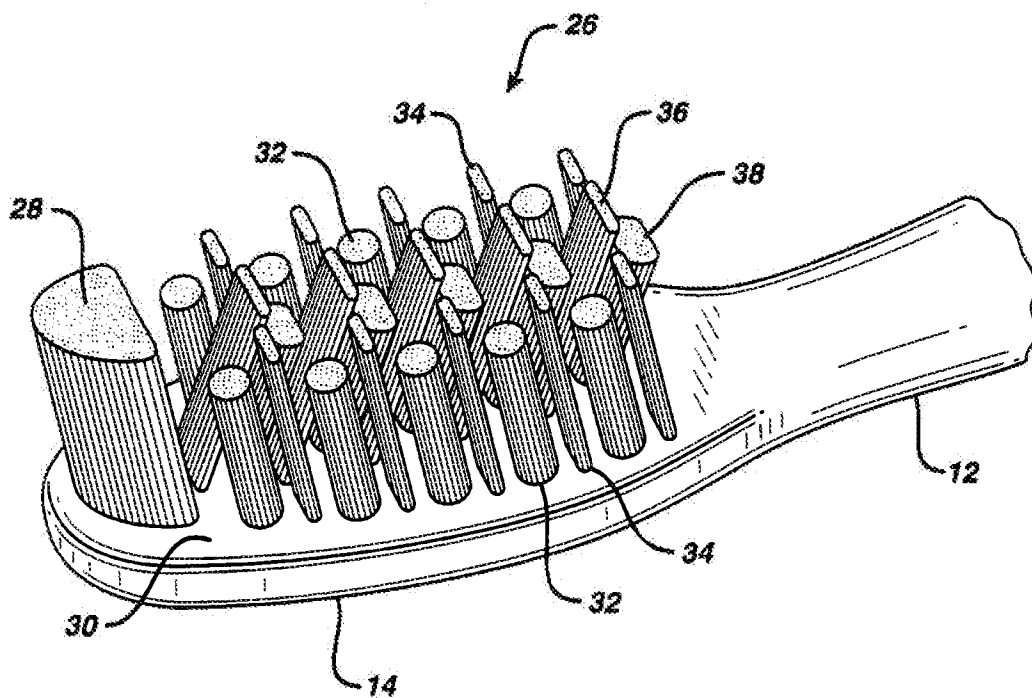
**FIG. 5**



**FIG. 6**



**FIG. 7**



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/23780

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : A46B 9/04

US CL : 15/167.1

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 15/167.1, DIG. 5; D4/104, 105, 106, 107, 110

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,398,368 A (ELDER) 21 March 1995, col. 3, lines 18-21.	1-3
X -- Y	US 5,628,082 A (MOSKOVICH) 13 May 1997, fig. 16, col. 6, lines 7-29.	1,4,6-11, 13-15,19, 24 ----- 5,12
X	US 5,446,940 A (CURTIS et al) 05 September 1995, see figs. 1, 4a, 16, and 17, col. 4, lines 32-35.	11,13-17, 19,20
X	US D.372,584 A (YOST et al.) 13 August 1996, fig. 1-3.	11,15,18, 19
X,P	US 5,802,656 A (DAWSON et al) 08 September 1998 (filed 27 November 1996), fig. 22-24.	21-23

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search

17 DECEMBER 1998

Date of mailing of the international search report

29 JAN 1999

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/23780

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,459,899 A (BAUER) 24 October 1995, col. 3, lines 9-18.	5,12